CLAIMS

WHAT IS CLAIMED IS:

1. A method for making a piezoelectric transducer having a plurality of intertwined individual helical transducer segments from comprising:

machining a ceramic material blank into a tubular configuration to form a ceramic tube;

coating the ceramic tube with a metallic layer;

machining the metal coated ceramic tube to form an inner electrode and a plurality of helically intertwined outer electrodes, each outer electrode being associated with a functionally discrete transducer segment;

transforming the ceramic material forming the ceramic tube into a piezoelectric crystal.

2. The method of claim 1 wherein the step of machining the blank comprises core drilling and turning the blank using a CNC machine.

3. The method of claim 2 wherein the step of core drilling and turning the blank comprises utilizing a quadruple YAG laser at about 700 nanometer wavelength, hooked to a rotary mandrel CAD/CAM machine.

4. The method of claim 1 wherein the step of coating the tubular ceramic material with a metallic layer comprises plating the tubular ceramic material using a metal plating process.

5. The method of claim 1 wherein the step of coating the tubular ceramic material with a metallic layer comprises sputtering the ceramic tube with metal using a sputtering process.

6. The method of claim 1 wherein the step of machining comprises laser etching the metallic coating over the ceramic tube to form inner and outer electrodes.

7. The method of claim 1 wherein the step of machining comprises laser etching the metallic coating over the ceramic tube to form helical grooves that segment the transducer into the functionally discrete transducer segments.

8. The method of claim 1 wherein the step of transforming the ceramic material forming the ceramic tube into a piezoelectric crystal comprises shorting the transducer segments.

9. The method of claim 8 wherein the step of shorting the transducer segments comprises creating a temporary connection of comparatively low resistance between the transducer segments.

10. The method of claim 1 wherein the step of transforming the ceramic material forming the ceramic tube into a piezoelectric crystal comprises poling the ceramic tube.

11. The method of claim 10 wherein the step of poling the ceramic tube comprises:

heating the ceramic tube beyond its Kerrie point; and

apply an electric field.

12. The method of claim 1 further comprising the step of polishing the outer surface of the ceramic tube before coating the ceramic tube with a metallic layer.

13. The method of claim 12 wherein the step of polishing the outer surface of the ceramic tube comprises:

mounting the ceramic tube to a spinning mandrel;

rotating the mandrel at a high rate of speed; and

contacting the rotating ceramic tube with a fine abrasive material.

14. The method of claim 1 further comprising the step of mounting the ceramic tube to a mandrel for addition support during machining.

15. The method of claim 1 further comprising the step of applying a matching layer over the segmented transducer.

16. The method of claim 15 wherein the step of applying a matching layer comprises laminating the matching layer over the transducer.

17. The method of claim 15 wherein the step of applying a matching layer comprises coating the transducer with a polymer using a process selected from the group consisting of spray coating, dip coating, chemical vapor deposition, plasma coating, co-extrusion coating, spin coating and insert molding.

18. A method of making a piezoelectric transducer, having a plurality of intertwined helical transducer segments, from a PZT ceramic tube comprising:

coating the inside and outside of the ceramic tube with a metallic layer to form an inner electrode and an outer electrode; and

etching at least the outer electrode to form a plurality of intertwined helical transducer segments.

19. A method of making an ultrasound transducer with a helical phased array comprising:

providing a cylindrical piezoelectric transducer having a piezoelectric material disposed between a cylindrical inner electrode and a cylindrical outer electrode;

machining grooves through at least the outer electrode to segment the transducer into a plurality of functionally discrete intertwined helical transducer segments.